# CMF20B65D

## 650V,20A Field Stop Trench IGBT

## General Description

Cmos's Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses. The device is designed for Motor applications where ruggedness is a required feature.

## Product Summary

| VCES | IC |
|---|---|
| 650V | 20A |

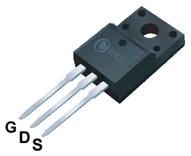
## Applications

- Motor drives
- Uninterruptible Power Supply

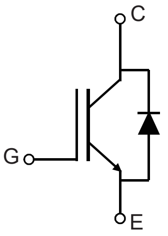
## Features

- High speed switching
- High input impedance
- RoHS Compliant

## TO-220F Pin Configuration



TO-220F
(CMF20B65D)



## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$@$T_C$=25℃ | Collector Current | 40 | A |
| $I_C$@$T_C$=100℃ | | 20 | A |
| $I_{CM}$ | Pulsed Collector Current * | 60 | A |
| $I_F$@$T_C$=100℃ | Diode Continuous Forward Current | 10 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 30 | A |
| $P_D$@$T_C$=25℃ | Maximum Power Dissipation | 37 | W |
| $P_D$@$T_C$=100℃ | Maximum Junction Temperature | 18.5 | W |
| $T_{Vj}$ | Operating Junction temperature range | -40 to 150 | ℃ |
| $T_{stg}$ | Storage temperature range | -40 to 150 | ℃ |

* Repetitive rating : Pulse width limited by max. junction temperature

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{thJA}$ | Thermal Resistance, Junction-Ambient | --- | 78 | ℃/W |
| $R_{thJC}$ | Thermal Resistance, IGBT Junction-Case | --- | 3.4 | ℃/W |
| $R_{thJC}$ | Thermal Resistance, Diode Junction-Case | --- | 4.5 | ℃/W |

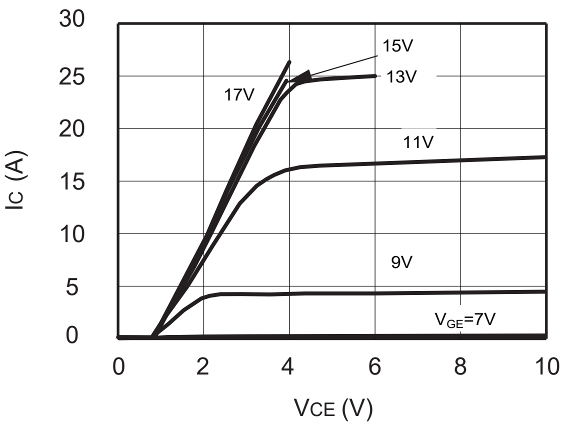
## Electrical Characteristics ($T_J$=25℃ , unless otherwise noted)

| Symbol | Characteristic | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Static | | | | | | |
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{CE}$=0V , $I_C$=250μA | 650 | --- | --- | V |
| $I_{CES}$ | Collector Cut-off Current | $V_{GE}$=0V , $V_{CE}$=650V, $T_{vj}$ = 25℃ | --- | --- | 10 | μA |
| $I_{GES}$ | Gate Leakage Current | $V_{CE}$ =0V , $V_{GE}$=±20V | --- | --- | ±100 | nA |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $V_{CE}$ = $V_{GE}$ , $I_C$=250μA | 4.5 | 5.7 | 6.5 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$=20A, $T_{vj}$ = 25℃ | --- | 1.8 | 2.2 | V |
| | | $V_{GE}$=15V, $I_C$=20A, $T_{vj}$ = 150℃ | --- | 2.1 | --- | V |
| Dynamic | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{CC}$=400V, $V_{GE}$=15V, $I_C$= 20A | --- | 35 | --- | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | --- | 12 | --- | |
| $Q_{gc}$ | Gate-Collector Charge | | --- | 19 | --- | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=400V, $I_C$=20A, $V_{GE}$=15V,<br>$R_G$=10Ω<br>Inductive Load , $T_{vj}$ = 25℃ | --- | 23 | --- | ns |
| $t_r$ | Rise Time | | --- | 19 | --- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | --- | 80 | --- | |
| $t_f$ | Fall Time | | --- | 93 | --- | |
| $E_{on}$ | Turn-On Switching Loss | | --- | 0.41 | --- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | --- | 0.48 | --- | |
| $E_{total}$ | Total Switching Energy | | --- | 0.89 | --- | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V , $V_{GE}$ =0V , f=1MHz | --- | 1500 | --- | pF |
| $C_{oes}$ | Output Capacitance | | --- | 75 | --- | |
| $C_{res}$ | Reverse Transfer Capacitance | | --- | 35 | --- | |

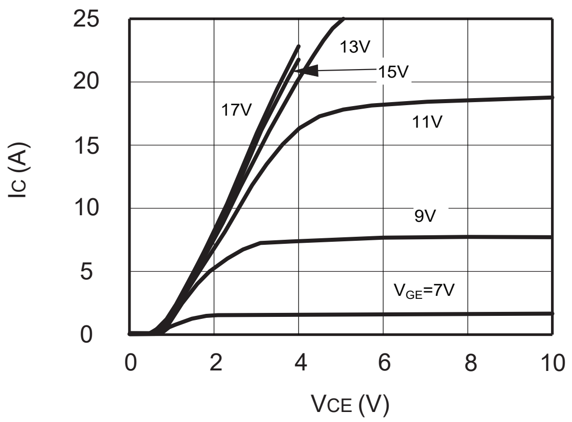
## Electrical Characteristic Of Diode

| Symbol | Characteristic | Test Condition | | Mim. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$ = 10A | $T_C$=25℃ | --- | 1.7 | --- | V |
| | | | $T_C$=150℃ | --- | 1.5 | --- | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ =10A<br>$V_R$=650V | $T_C$=25℃ | --- | 112 | --- | ns |
| $I_{rm}$ | Diode Peak Reverse Recovery Current | | $T_C$=25℃ | --- | 6.4 | --- | A |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$=25℃ | --- | 0.63 | --- | μC |

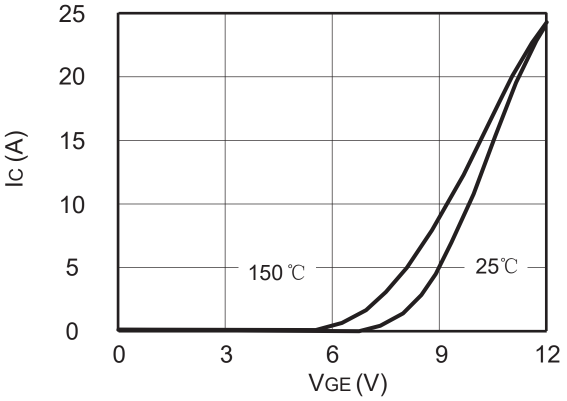
## Typical electrical and thermal characteris



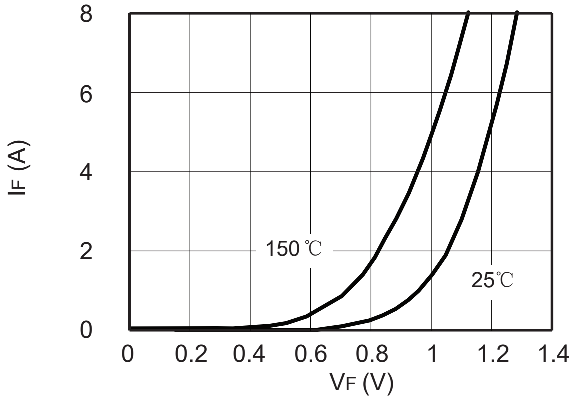
Output Characteristic (Tj=25℃)



Output Characteristic (Tj=150℃)

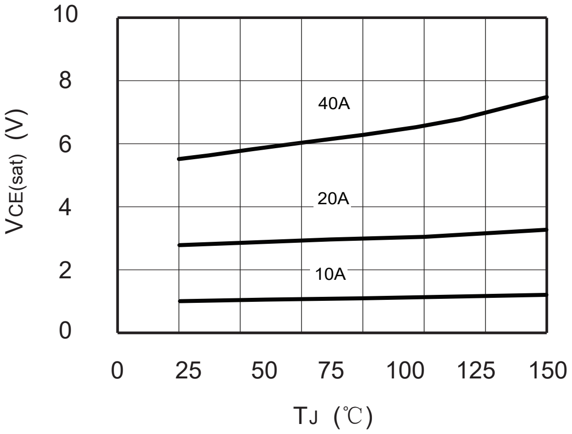


Transfer Characteristic

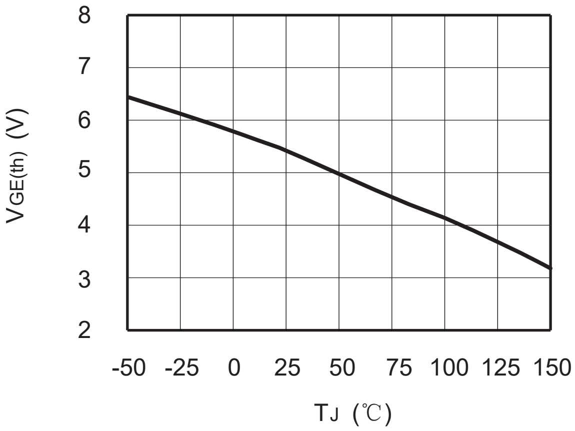


Diode Characteristic

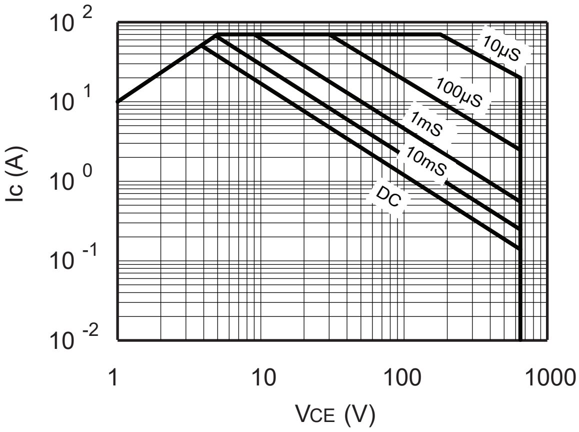
## Typical electrical and thermal characteris



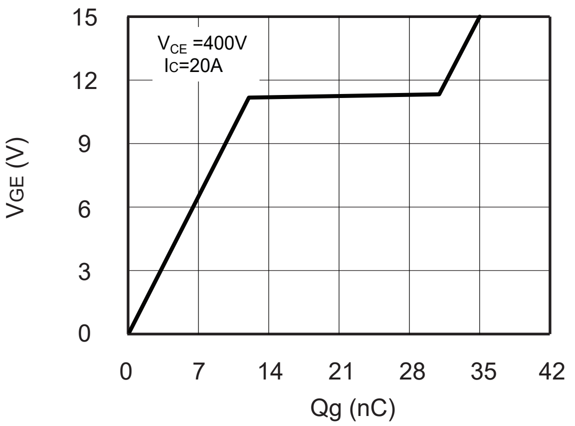
Collector-Emitter Saturation Voltage vs. Junction Temperature



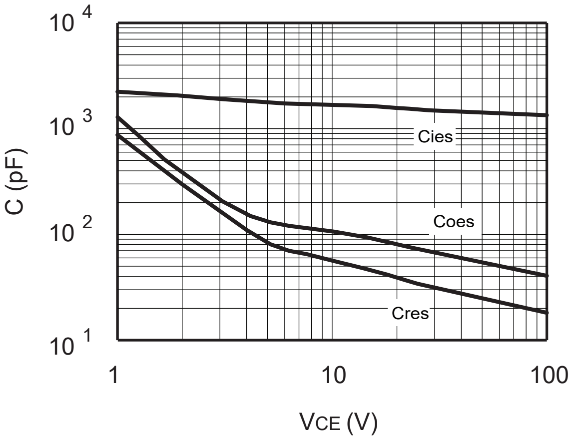
Junction temperature Vs. VGE(th)



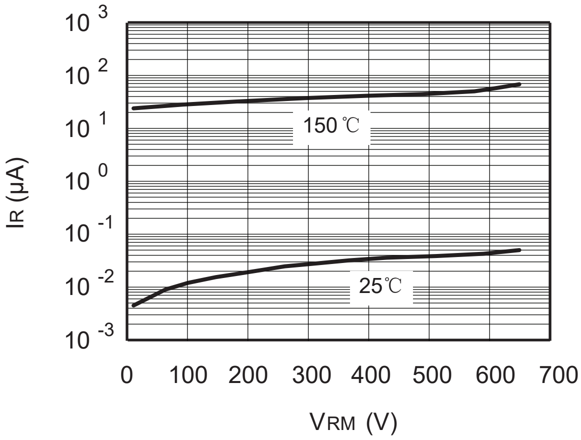
Forward bias safe operating area



Gate-Charge Characteristics



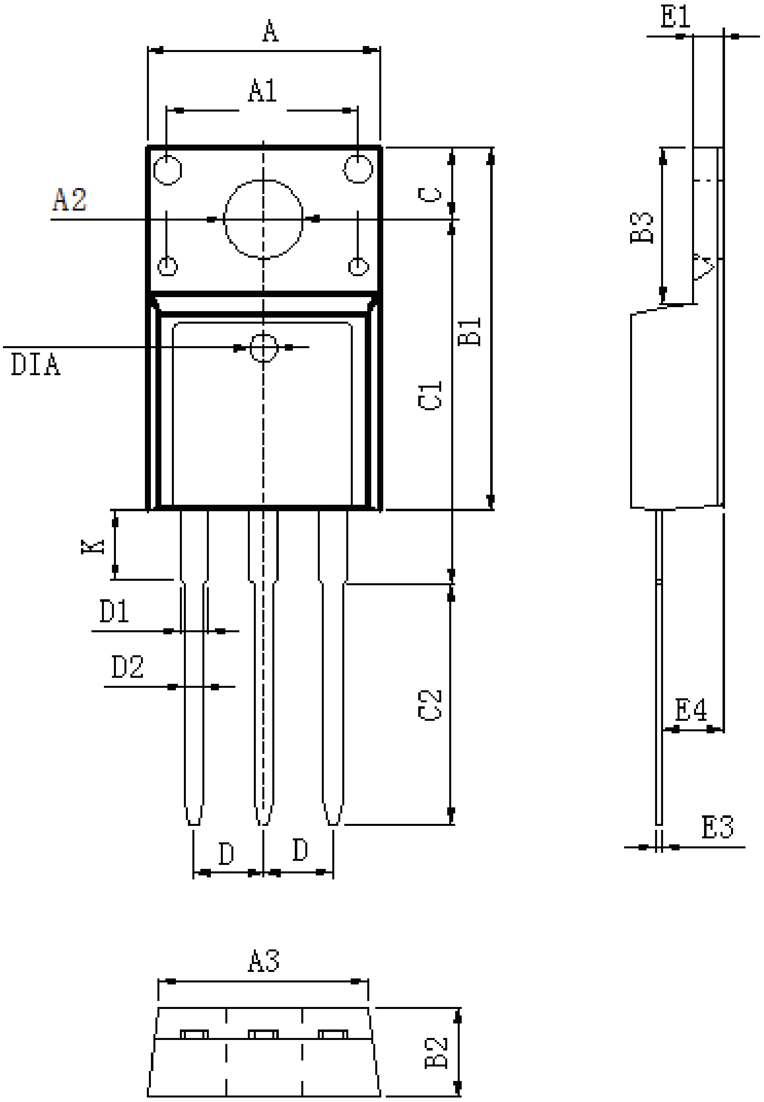
Capacitance Characteristic



Diode junction temperature Vs. Leakage Current

## Package Dimension

TO-220F Unit :mm



| DIM | MILLIMETERS |
|---|---|
| A | 10.16±0.3 |
| A1 | 7.00±0.1 |
| A2 | 3.3±0.2 |
| A3 | 9.5±0.2 |
| B1 | 15.87±0.3 |
| B2 | 4.7±0.2 |
| B3 | 6.68±0.4 |
| C | 3.3±0.2 |
| C1 | 12.57±0.3 |
| C2 | 10.02±0.5 |
| D | 2.54±0.05 |
| D1 | 1.28±0.2 |
| D2 | 0.8±0.1 |
| K | 3.1±0.3 |
| E1 | 2.54±0.1 |
| E3 | 0.5±0.1 |
| E4 | 2.76±0.2 |
| DIA | ⊙1.5(deep 0.2) |